APPENDIX B:
Annotated Bibliography of Inadvertent Activation of Machine Controls

#1434

INADVERTENT ACTIVATION OF MACHINE CONTROLS

Selected Annotated References

CODE OF FEDERAL REGULATIONS

1. "Woodworking machinery requirements," ***29 CFR 1910.213***. Washington: Occupational Safety and Health Administration, as published in the *Federal Register* v.36 #1055 Part II (May 29, 1971): 10633, 10635.
   (b) *Machine controls and equipment*
   "**(6)** Each operating treadle shall be protected against unexpected or accidental tripping."
   (l) *Boring and mortising machines*.
   "**(6)** Each operating treadle shall be covered by an inverted U-shaped metal guard, fastened to the floor, and of adequate size to prevent accidental tripping."

2. "Woodworking machinery requirements," ***29 CFR 1910.213***. Washington: Occupational Safety and Health Administration, as published in 29 CFR, Parts 1900 to 1910.999, revised as of July 1, 1996, pp. 568, 571.
   (b) *Machine controls and equipment*
   "**(6)** Each operating treadle shall be protected against unexpected or accidental tripping."
   (l) *Boring and mortising machines*.
   "**(6)** Each operating treadle shall be covered by an inverted U-shaped metal guard, fastened to the floor and of adequate size to prevent accidental tripping."

3. "Mechanical power presses," ***29 CFR 1910.217***. Washington: Occupational Safety and Health Administration, May 29, 1971, as published in the *Federal Register* v. 36 #105 Part II (May 29 1971): 10643.
   (b) *Mechanical power press guarding and construction, general-*
   (4) *Foot pedals (treadle)*.
   "**(i)** The pedal mechanism shall be protected to prevent unintended operation from falling or moving objects or by accidental stepping onto the pedal."
   (5) *Hand operated levers*.
   "**(i)** Hand-lever-operated power presses shall be equipped with a spring latch on the operating lever to prevent premature or accidental tripping."
   (6) *Two-hand trip*.
   "**(i)** A two-hand trip shall have the individual operators hand controls protected against unintentional operation and have the individual operators hand controls arranged by design and construction and/or separation to require the use of both hands to trip the press and use a control arrangement requiring concurrent operation of the individual operators hand controls."

(7) *Machines using part revolution clutches.*
"(iv) The "inch" operating means shall be designed to prevent exposure of the workers hands within the point of operation by:...
(b) Being a single control protected against accidental actuation and so located that the worker cannot reach into the point of operation while operating the single control."
"(v) Two-hand controls for single stroke shall; conform to the following requirements:
(a) Each hand control shall be protected against unintended operation and arranged by design, construction, and/or separation so that the concurrent use of both hands is required to trip the press."
"(x) Foot operated tripping controls, if used, shall be protected so as to prevent operation from falling or moving objects, or from unintended operation by accidental stepping onto the foot control."

4. "Mechanical power presses," ***29 CFR 1910.217***. Washington: Occupational Safety and Health Administration, amended March 7, 1996, as published in the *Code of Federal Regulations, title 29*, parts 1900 to 1910.999, revised as of July 1, 1996, pp. 586, 587
(b) *Mechanical power press guarding and construction, general* -
(4) *Foot pedals (treadle).*
"(i) The pedal mechanism shall be protected to prevent unintended operation from falling or moving objects or by accidental stepping onto the pedal."
(5) *Hand operated levers.*
"(i) Hand-lever-operated power presses shall be equipped with a spring latch on the operating lever to prevent premature or accidental tripping."
(6) *Two-hand trip.*
"(i) A two-hand trip shall have the individual operator's hand controls protected against unintentional operation and have the individual operator's hand controls arranged by design and construction and/or separation to require the use of both hands to trip the press and use a control arrangement requiring concurrent operation of the individual operator's hand controls."
(7) *Machines using part revolution clutches.*
"(iv) The "inch" operating means shall be designed to prevent exposure of the workers hand within the point of operation by:...
(b) Being a single control protected against accidental actuation and so located that the worker cannot reach into the point of operation while operating the single control."
"(v) Two-hand controls for single stroke shall conform to the following requirements:

(a) Each hand control shall be protected against unintended operation and arranged by design, construction, and/or separation so that the concurrent use of both hands is required to trip the press."

"(x) Foot-operated tripping controls if used, shall be protected so as to prevent operation from falling or moving objects, or from unintended operation by accidental stepping onto the foot control."

5. "Forging machines," ***29 CFR 1910.218***. Washington: Occupational Safety and Health Administration, May 29, 1971, as published in the *Federal Register* v. 36 #105 Part II (May 29, 1971): 10646.

(b) *Hammers, general* -

"(2) *Foot operated devices*. All foot operated devices (i.e. treadles, pedals, bars, valves, and switches) shall be substantially and effectively protected from unintended operation."

6. "Forging Machines," ***29 CFR 1910.218***. Washington: Occupational Safety and Health Administration, amended March 6, 1996, as published in the *Code of Federal Regulations, title 29*, parts 1900 to 1910.999, revised as of July 1, 1996, p. 615.

(b) *Hammers, general*

"(2) *Foot operated devices*. All foot operated devices (i.e. Treadles, pedals, bars, valves, and switches) shall be substantially and effectively protected from unintended operation."

7. "Guarding of portable powered tools," ***29 CFR 1910.243***. Washington: Occupational Safety and Health Administration, May 29, 1971, as published in the *Federal Register* v. 36 #105 Part II (May 29, 1971): 10653, 10654.

(b) *Pneumatic powered tools and hose-*

(1) *Portable tools*.

"(i) The operating trigger on portable hand-operated utilization equipment shall be so located as to minimize the possibility of its accidental operation and shall be arranged to close the air inlet valve automatically when the pressure of the operator's hand is removed."

(d) *Explosive Actuated fastening tools* -

(2) *Inspection, maintenance, and tool handling* -

"(d) (1) The firing mechanism shall be so designed that it cannot fire during loading or preparation to fire, or if the tool should be dropped while loaded."

"(ii) Tools of the low-velocity-piston type shall have the characteristics out lined in (a) thought (e) of this subdivision and, at the discretion of the manufacturer, any additional safety features he may wish to incorporate....

(b) (1) The tool shall be so designed so that it shall not in ordinary usage

propel or discharge a stud, pin, or fastener while loading or during preparation to fire, or if the tool should be dropped while loaded."

8. "Guarding of portable powered tools," ***29 CFR 1910.243***. Washington: Occupational Safety and Health Administration, amended March 6, 1996, as published in *Code of Federal Regulations, title 29*, parts 1900 to 1910.999, revised as of July 1, 1996, pp. 624, 626-627.

(a) *Portable powered tools-*

(2) *Switches and controls*.

"**(iv)** The operating control on hand-held power tools shall be so located as to minimize the possibility of its accidental operation, if such accidental operation would constitute a hazard to employees."

(d) Explosive actuated fastening tools -

(2) *Inspection maintenance, and tool handling*

"**(d) (1)** The firing mechanism shall be so designed that the tool cannot fire during loading or preparation to fire, or if the tool should be dropped while loaded."

"**(ii)** Tools of the low-velocity-piston type shall have the characteristics outlined in paragraphs (d)(2)(ii) (a) through (e) of this section and any additional safety features he may wish to incorporate."

"**(b)(1)** The tool shall be designed so that it shall not in ordinary usage propel or discharge a stud, pin, or fastener while loading or during preparation to fire, or if the tool should be dropped while loaded."

9. "Bakery equipment," ***29 CFR 1910.263***. Washington: Occupational Safety and Health Administration, May 29, 1971, as published in the *Federal Register v.* 36 #105 Part II (may 29, 1971): 10683.

(j) *Slicers and wrappers-*

"**(c)** Mechanical control levers for starting and stopping both slicing machine conveyors and wrapping machines shall be extended or so located that an operator in one location can control both machines. Such levers should be provided wherever necessary but these should be so arranged that there is only one station capable of starting the wrapping machine and conveyor assembly, and this starting station should be so arranged or guarded as to prevent accidental starting...."

10. "Bakery equipment," ***29 CFR 1910.263*** Washington: Occupational Safety and Health Administration, amended March 7, 1996, as published in the *Code of Federal Regulations, title 29*, parts 1900 to 1910.999, revised July 1, 1996, p. 682.

(j) *Slicers and wrappers*.

"**(c)** Mechanical control levers for starting and stopping both slicing machine conveyors and wrapping machines shall be extended or so

located that an operator in one location can control both machines. Such levers should be provided wherever necessary but these should be so arranged that there is only one station capable of starting the wrapping machine and conveyor assembly, and this starting station should be so arranged or guarded as to prevent accidental starting...."

ANSI STANDARDS

11. "Safety Code for Power Presses and Foot and Hand Presses" *ANSI B11 1937*. New York: American Standards Association, approved October 22, 1937, p. 10, 12, 16.

6. *Other Press Guards*

"**6.1** *Treadle Guards*

On every foot-operated power press a substantial guard shall be placed over the treadle to prevent accidental tripping, or an equally effective special design of treadle shall be used. For treadles other than long bars extending across the machine the openings in such guards shall not be more than twice the width of the foot.

6.2 *Latch on Hand Lever*.

Hand-operated power presses, especially if of large size, should be equipped with a spring latch on the lever to prevent accidental or premature tripping.

6.3 *Interlocking Device*.

Each hand-operated power press, if tended by more than one man, should have an interlocking lever or similar device controlled by the helper to prevent accidental or premature tripping."

Appendix

A. *Power-Press Hazards*

"**202** *Accidental Tripping*. The table shows than another important cause of accidents is accidental depression of the treadle, as by

(a) A falling object.
(b) Drifting because of poor braking (Brake becoming loose or brake bolt shearing off).
(c) Dog Breaking.
(d) Latch return spring breaking or coming loose.
(e) Pitman breaking, allowing ram to drop.
(f) Square-jawed clutch burring and sticking.
(g) Gummed oil or grease on the pulley."

F. *Gate Guards*

"**227** *Need for Supervision: Repeating*. Gate guards, in connection with the tripping mechanism, must be carefully maintained and supervised to prevent being thrown out of adjustment intentionally or unintentionally. They should be so constructed as to prevent reaching around, over, or under the guard.

Most gate guards are preferable to sweep guards in one respect, because when the treadle or hand lever is operated the gate completely encloses the point of operation before the clutch can become engaged...."

12. "Safety Code for Power Press and Foot and Hand Presses," *ASA B11.1 1948*. New York: American Standards Association, approved January 12, 1948, pp. 9, 12.
4 *Requirements for Press Installation*
"**4.6** *Switches and Other Electrical Apparatus*
4.6.1 Power switches and other electrical apparatus shall be guarded. Push buttons for starting motors shall be so located or guarded that motor or motors cannot be accidentally started. Motor-starting push buttons may be line voltage up to 550 volts."
7 *Other Power-Press Safety Devices*
"**7.1** *Treadle Guard*. On every foot-operated power press a substantial guard shall be placed over the treadle to prevent accidental tripping, or an equally effective special design of treadle shall be used. For treadles, other than long bars extending across the machine the openings in such guards shall be not more than twice the width of the foot."
"**7.3** *Latch on Hand-Operating Lever*. Hand-operated power presses, especially if of larger size, should be equipped with a spring latch on the operating lever to prevent accidental or premature tripping.
7.4 *Interlocking Device*. Each hand-operated power press, if tended by more than one person, should have an interlocking lever or similar device controlled by each person to prevent accident or premature tripping. (See 5.5.)"

13. "Mechanical Power Presses, Safety Requirements for the Construction, Care, and Use of," *ANSI B11.1 1971*. New York: American National Standards Institute, approved February 17, 1971, pp. 24, 26, 28-29.
3 *Construction, Reconstruction, and Modification*
3.4 *Machines Using Full Revolution Clutches*
3.4.3 *Foot Pedal (Treadle)*
"**3.4.3.3** *Unintended Operation*
The pedal mechanism shall be protected to prevent unintended operation from falling or moving objects, or by accidental stepping onto the pedal."
3.4.4 *Hand Operated Levers*
"**3.4.4.1** *Latch*. Hand lever operated power presses shall be equipped with a spring latch on the operating lever to prevent premature or accidental tripping."
"**3.4.5** *Two Hand Trip*. A two hand trip shall:
(1) have the individual operator's hand controls protected against unintentional operation, and..."
3.5 *Machines using Part Revolution Clutches*

3.5.2 *Controls*

"**3.5.2.4** *Single Stroke Two Hand Control*

Two hand controls for single stroke, when furnished, shall conform to the following requirements:

(1) *Two Hand Trip*. Each hand control shall be protected against unintended operation and arranged by design, construction and/or separation so that the concurrent use of both hands is required to trip the press."

"**E3.5.2.4** *Single Stroke Two Hand Control*

(1) *Two Hand Trip*. The use of rings around the palm-operated buttons protects them from unintentional operation. Precautions in design or installation are needed to prevent operation of two buttons by the use of one hand and the elbow of the same arm, or other such attempts to circumvent the two hand requirement."

"**3.5.2.8** *Foot Control*. Foot operated tripping controls, if used, shall be protected so as to prevent operation from falling or accidental stepping onto the foot control."

3.6 *Electrical*

"**3.6.2** *Motor Start Button*

The motor start button shall be protected against accidental operation."

14. "Mechanical Power Presses - Safety Requirements for Construction, Care, and Use," ***ANSI B11.1 1988 (reaffirmed 1994)***. New York: American National Standards Institute, approved April 4, 1988, pp. 22, 27-28, 30, 34-35.

4. *Construction, Reconstruction, and Modification*

4.4 *Electrical Requirements*: The following electrical requirements shall apply:

"**4.4.2** *Motor-Start Button*. The motor-start button shall be protected against accidental actuation."

"**E4.4.2** *Motor-Start Button*. Examples of protection against accidental actuation may include, but are not limited to, recessed buttons, flush buttons, pull on-push off, ring guards, and fabricated shields."

4.12 *Presses Using Full-Revolution Clutches*.

"**4.12.3** *Trip Mechanism*

4.12.3.1 *Foot Pedal*. When a foot pedal is furnished, it shall be designed for actuation by one foot only and meet the following requirements:...

(3) *Unintended Actuation*. The pedal mechanism shall be protected to prevent unintended actuation from falling or moving objects, or by accidental stepping onto the pedal."

"**4.12.4** *Trip-Control System*. The requirements in this section shall apply to electrical or pneumatic controls used to actuate full-revolution clutch presses."

"**4.12.4.2** *Operating Modes*...

(2) *Jog*. The JOG mode, if provided, shall be designed to prevent exposure of the worker's hands within the point of operation."

"**E4.12.4.2** *Operating Modes*

(2) *Jog*. Methods of meeting this requirement include:...

(b) Having a single control protected against accidental actuation and so located that the worker cannot reach into the point of operation while operating the single control."

"**4.12.4.4** *Actuating Means*

(1) *Two-Hand Trip Control*. Each hand control shall be protected against unintended actuation and shall be arranged by design, construction, or separation so that the concurrent use of both hands is required to trip the press....

(2) *One-Hand Trip Control*. If one-hand trip control is provided, it shall be protected against inadvertent or unintended actuation. If the press is equipped with two-hand trip controls, the one-hand trip control shall be a separate control. Selection of one-hand trip control or two-hand trip control shall be capable of being supervised by the employer.

(3) *Foot Trip Control*. Foot-actuated trip controls, if provided, shall be protected to prevent actuation from falling or moving objects, or from unintended initiation of a press stroke by inadvertently stepping onto the foot trip control."

"**E4.12.4.4** *Actuating Means*

(1) *Two-Hand Trip Control*. This is a construction requirement applying only if the press is equipped with a two-hand trip control. Two-hand trip control typically is accomplished by:...

(d) Rings or shrouds are commonly used to protect palm-actuated buttons from unintended actuation. Precautions in design or installation are needed to prevent actuation of two buttons by the use of one hand and the elbow of the same arm and to inhibit other circumvention of the two-hand requirement."

4.13 *Presses Using Part-Revolution Clutches*.

4.13.3 *Controls*

"**4.13.3.5** *Actuating Means*

(1) *Two-Hand Control*. Each hand control shall be protected against unintended actuation and shall be arranged by design, construction, or separation so that the concurrent use of both hands is required to initiate the press.

(2) *One-Hand Control*. If one-hand control is provided, it shall be protected against inadvertent or unintended actuation. If the press is equipped with two-hand control, the one-hand control shall be a separate control. Selection of one-hand control or two-hand control shall be capable of being supervised by the employer.

(3) *Foot Control*. Foot-operated controls, if provided, shall be protected to prevent actuation from falling or moving objects, or from unintended actuation by accidental stepping onto the foot control."

"**E4.13.3.5** *Actuating Means*

(1) *Two-Hand Control*. Rings or shrouds may satisfy the requirement to protect palm-operated buttons from unintentional actuation. Precautions in design or installation are needed to prevent actuation of two buttons by the use of one hand and the elbow of the same arm, and to inhibit other circumvention of the two-hand requirement."

15. "Hydraulic Presses - Safety Requirements for Construction, Care and Use," ***ANSI B11.2 1982***. New York: American National Standards Institute, approved April 30, 1982, pp. 14, 17.

3. *Construction, Reconstruction, and Modification*

3.3 *Actuating Controls*.

"**3.3.1** *Protection from Unintended Operation*. The control mechanism shall be protected to prevent unintended operation that may be caused by falling or moving objects or by accidental actuation of the control.

Release of the control actuator(s) shall not cause unintended machine motion."

3.5 *General Electrical Requirements*

"**3.5.4** *Motor(s) Start Button*. When provided, the motor(s) start button shall be protected against accidental operation."

"**E3.5.4** Motor(s) Start Button. It is recommended that the start button be illuminated and/or that a pilot light be used to indicate that the motor is running."

16. "Hydraulic Power Presses - Safety Requirements for Construction, Care, and Use," ***ANSI B11.2 1995***. New York" American National Standards Institute, approved February 13, 1995, pp. 20-22, 36, 38.

6. *Construction, reconstruction and modification*

6.3 *Control system*

"**6.3.9** *Actuating means*

(1) *Two-hand control*: When two-hand control is provided, each hand control shall be provided against unintended actuation and shall be arranged by design, construction, or separation so that the concurrent use of both hands is required to initiate the press stroke. The two-hand control shall be designed and constructed to require the release of all operator's hand controls and the reactuation of all controls before a press stroke may be initiated.

(2) *Two-hand trip control*: Each hand control shall be provided against unintended actuation and shall be arranged by design, construction, or

separation so that the concurrent use of both hands is required to initiate the press stroke.

(3) *One-hand control*: When one-hand control is provided, it shall be protected against unintended actuation. If the press is equipped with both one-hand and two-hand control, either the one-hand control shall be a separate control, or a means shall be provided to prevent or stop cycling if both hand controls are actuated while one-hand control is selected.

(4) Foot control: Foot controls, when provided, shall be protected to prevent actuation by falling or moving objects, or from unintended operation by accidental stepping onto the foot pedal.

"**E6.3.9**

(1) Rings, partial rings or shrouds may be used to protect palm-operated buttons from unintentional operation. Precautions in design or installation are needed to prevent operation of two buttons by the use of one hand and the elbow of the same arm, and to inhibit other circumvention of the two-hand requirement.

(4) This is intended to require the operator to intentionally place a foot on the actuating control. It cannot prevent unintentional operation once the foot is placed within the shroud."

6.4 *General electrical requirements*

"**6.4.2** *motor(s) start button*

When provided, the motor(s) start button shall be protected against accidental operation."

8 *Safeguarding point of operation*

8.4 *Point-of-operation safeguarding devices*

"**8.4.4** *Two-hand control device*

A two-hand control device, if used, shall protect the operator as specified in 8.4(4). In addition,...

(2)...Each hand control shall be protected against unintended actuation and shall be arranged by design, construction, or separation so that the concurrent use of both hands is required to initiate the press."

"**8.4.5** *Two-hand trip used as a device*

A two-hand trip, when so used, shall protect the operator as specified in 8.4(4). In addition,...

(3) Each hand control shall be protected against unintended actuation and shall be arranged by design, construction, or separation so that the concurrent use of both hands is required to initiate the press."

"**E8.4.5**

(3) Rings or shrouds may be used to protect palm operated buttons from unintentional operation. Precautions in design or installation are needed to prevent operation of two buttons by the use of one hand and the elbow of

the same arm, and to inhibit other circumvention of the two-hand trip requirement."

17. "Power Press Brakes - Safety Requirements for the Construction, are, and Use of," *ANSI B11.3 1973*. New York: American National Standards Institute, approved February 15, 1973, pp. 23-26, 30-31, 35-36, 38, 41.

4. *Construction, Reconstruction, and Modification*

4.2 *Mechanical Press Brake*

4.2.4 *Stroking Control*

"**4.2.4.1.4** *Foot-Pedal Actuation Prevention*. When a foot pedal is furnished with the press brake, a means shall be provided for preventing any accidental operation of the press brake."

"**E4.2.4.1.4** *Foot-Pedal Actuation Prevention*. Two methods of fulfilling this requirement are:

(1) Removing the foot pedal and placing it in a safe location.

(2) Providing a locking pin or locking lever, as noted in Illustration 14. These locking mechanisms should be designed to inhibit accidental actuation, but not to allow locking in the operating position. For additional operator safety in foot-pedal type operations, it is recommended that the locking device (pin or lever) be used to prevent actuation of the press brake when not in operation."

"**4.2.4.1.5** *Foot-Treadle-Bar Actuation Prevention*. When a foot-treadle bar is furnished with the press brake, a means shall be provided for locking the treadle bar to inhibit its accidental actuation."

"**E4.2.4.1.5** *Foot-Treadle-Bar Actuation Prevention*. Two methods of fulfilling this requirement are:

(1) Providing a protective cover over the treadle bar to inhibit accidental actuation by other objects.

(2) Providing a locking pin or locking lever to lock the treadle bar in a fixed position. These locking mechanisms should be designed to inhibit accidental actuation, but not to allow locking in the operating position."

4.2.4.2 *Air-Type Clutch Brake*

"**4.2.4.2.1** *Inch*. Machines with air-type clutch/brake shall be designed so as to allow the die setter to have complete control over the ram movement for setting dies, through the actuation of a remote foot control.

The remote foot control shall be protected against accidental actuation and so located that the operator cannot reach into the point of operation while actuating the foot control. If the single control is not remote, the requirements given in 4.4.4.1.2(1) applies."

"**4.2.4.2.4** *Foot-Control Actuation Prevention* . The foot control shall be protected so as to inhibit accidental actuation by falling or moving

objects, or by someone stepping on it. Means shall be provided for manually locking the foot control to inhibit such accidental actuation."

"**E4.2.4.2.4** *Foot-Control Actuation Prevention*. One way of preventing or inhibiting accidental actuation of the foot control would be to provide a key-operated selector switch. Another way of providing against accidental actuation is shown in Illustration 15. (Shows a Mechanical Locking Pin)."

4.2.5 *Electrical*

"**4.2.5.2** *Main Drive-Motor Start-Button Actuation Prevention*. The main drive-motor start button shall be protected against accidental actuation."

"**E4.2.5.2** *Main Drive-Motor Start-Button Activation Prevention*. One means is to install a depressed motor-start button."

4.3 *Hydraulic Press Brake*

"**4.3.4** *Stroking Control*. The stroking control shall be of the highest order of reliability. I shall incorporate design features that minimize the possibility of unintended movement of the ram as the result of the failure of any component part to function properly."

"**4.3.4.3** *Foot Control*. A foot control, if used, shall be protected so as to inhibit accidental actuation by falling or moving objects, or by someone stepping on it."

4.3.5 *Electrical*

"**4.3.5.2** *Main Drive -Motor Start-Button Actuation Prevention*. The hydraulic-pump-motor start button shall be protected against accident actuation."

"**E4.3.5.2** *Main Drive Motor Start-Button Actuation Prevention*. One means is to install a depressed motor-start button."

4.4 *Special-Purpose Mechanical or Hydraulic Press Brake*.

"**4.4.4** *Stroking Control*. Control over the stroke of the ram to assure only intended function shall be of the highest order of reliability.

It shall incorporate design features that minimize the possibility of unintended movement of the ram as the result of the failure of any component part to function properly."

"**4.4.4.1.3** *Single Stroke*. Two-hand controls for single stroke, when furnished, shall conform to the following requirements:

(1) Each hand control shall be protected against unintended actuation and arranged by design, construction, or separation or a combination thereof, so that the concurrent pressure from both hand is required to trip the press brake."

"**E4.4.4.1.3** *Single Stroke*

(1) The use of rings around the palm-operated buttons protects them from unintentional actuation. Precautions in design or installation are needed to inhibit actuation of two buttons by the hand and elbow

of the same arm or other such attempts to circumvent the two-hand requirement."

"**4.4.4.3** *Foot Control.* A foot control, if used, shall be protected so as to inhibit accidental actuation by falling or moving objects, or by someone stepping on it."

4.4.5 *Electrical.*

"**4.4.5.2** *Main Drive-Motor Start-Button Actuation Prevention.* The main drive-motor, or hydraulic-pump-motor, start button shall be protected against accidental actuation."

18. "Power Press Brakes - Safety Requirements for Construction, Care, and Use." ***ANSI B11.3 1982 (reaffirmed 1994).*** New York: American National Standards Institute, approved February 18, 1982, pp. 30-33, 37-39, 45-48, 51, 78.

4. *Construction, Reconstruction, and Modification*

4.2. *General-Purpose Mechanical Power Press Brake*

4.2.4 *Stroking Control*

"**4.2.4.1.4** *Foot-Pedal (Mechanical) Actuation Prevention.* When a mechanical foot pedal is furnished with the power press brake, a means shall be provided for preventing accidental operation of the power press brake."

"**E4.2.4.1.4** *Foot-Pedal (Mechanical) Actuation Prevention.* Two methods of fulfilling this requirement are:

(1) Removing the mechanical foot pedal and placing it in a safe location.

(2) Providing a locking pin or locking lever, as noted in Illustration 24. These locking mechanisms should be designed to inhibit accidental actuation, but not allow locking in the operating position. For additional operator safety in mechanical foot-pedal type operation, it is recommended that the locking device (pin or lever) be used to prevent actuation of the power press brake when not in operation.".

"**4.2.4.1.5** *Foot-Treadle-Bar Actuation Prevention.* When a foot-treadle bar is furnished with the power press brake, a means shall be provided to inhibit its accidental actuation."

"**E4.2.4.1.5** *Foot-Treadle-Bar Actuation Prevention.* Two methods of fulfilling this requirement are:

(1) Providing a protective cover over the treadle bar to inhibit accidental actuation by other objects.

(2) Providing a locking pin or locking lever to lock the treadle bar in a fixed position. These locking mechanisms should be designed to inhibit accidental actuation, but not allow locking in the operating position."

4.2.4.2 *General-Purpose Power Press Brake Air-Type*

"**4.2.4.2.1** *Inch*. Machines with air-type clutch and brake, controlled directly by a foot control (valve), shall be designed so as to allow the die setter to have complete control over the ram movement for setting dies.

The foot control (valve) shall be protected against accidental actuation."

"**4.2.4.2.4** *Foot-Control (valve) Actuation Prevention*. The foot control (valve) shall be protected so as to inhibit accidental actuation by falling or moving objects, or by someone stepping on it."

"**E4.2.4.2.4** *Foot-Control (Valve) Actuation Prevention*. One way of preventing or inhibiting accidental actuation of the foot control; (valve) would be to provide a cover or mechanical locking pin, as shown in Illustration 25. (Illustration 25, Foot Control (Valve) with Stirrup Cover)."

4.2.5 *Electrical*

"**4.2.5.2** *Main Drive-Motor Start Button Actuation Prevention*. The main drive-motor start button shall be protected against accidental actuation."

"**E4.2.5.2** *Main Drive-Motor Start-Button Actuation Prevention*. One means is to install a depressed motor-start button."

4.3 *Hydraulic Power Press Brake*.

4.3.4 *Stroking Control*

"**4.3.4.1.2** *Inch*. The inch operating means shall be designed to inhibit exposure of the die setter's hands within the point of operation by either:...

(2) If it is a remote foot control, it shall be protected against accidental actuation and so located that the die setter cannot inadvertently place any part of his body into the point of operation while actuating the remote foot control; or..."

"**4.3.4.3** *Foot Control*. A foot control, if used, shall be protected so as to inhibit accidental actuation by falling or moving objects, or by someone stepping on it."

4.3.5 *Electrical*

"**4.3.5.2** *Main Drive-Motor Starter*. The hydraulic pump motor start button shall be protected against accidental actuation."

"**E4.3.5.2** *Main Drive-Motor Starter Actuation Prevention*. One means is to install a depressed motor-start button."

4.4 *Special-Purpose Mechanical or Hydraulic Power Press Brakes*.

4.4.4 *Stroking Control*.

"**4.4.4.1.2** *Inch*. The inch operating means shall be designed to inhibit exposure of the die setter's hands within the point of operation by either:...

(2) If it is a remote foot control, it shall be protected against accidental actuation and so located that the die setter cannot inadvertently place

any part of his body into the point of operation while actuating the remote foot control; or..."

"**4.4.4.1.3** *Single Stroke*. An operator control station for single stroke, when furnished, shall conform to the following requirements:

(1) Each two-hand operator control station shall be protected against unintended actuation and arranged by design, construction, or separation, or a combination thereof, so that the concurrent pressure from both hands is required to actuate the power press brake."

E4.4.4.1.3 *Single Stroke*.

"(1) The use of rings around the two-hand-operated buttons protects them from unintentional actuation. Precautions in design or installation are needed to inhibit actuation of two buttons by the hand and elbow of the same arm or other such attempt to circumvent the two-hand control requirement."

"**4.4.4.3** *Foot Control*. A foot control, if used, shall be protected so as to inhibit accidental actuation by falling or moving objects, or by someone stepping on it."

"**E4.4.4.3** *Foot Control*. In order to inhibit accidental actuation, the foot control may be protected by one or more of the following means:

(1) An employer's supervision key-locked control, or

(2) A manually locking provision, or

(3) A totally enclosed foot control.

The use of conventional foot valves or foot switches will meet the intent of this section if used in conjunction with the requirements of 6.1.4." (6 *Use*; 6.1 *Employer Responsibility*; 6.1.4 *Safeguarding the Point of Operation*).

4.4.5 *Electrical*

"**4.4.5.2** *Main Drive-Motor Start-Button Actuation Prevention*. The main drive-motor, or hydraulic pump motor, start button shall be protected against accidental actuation."

"**E4.4.5.2** *Main Drive-Motor Start-Button Actuation Prevention*. One means is to install a depressed motor-start button."

6. *Use*

6.1. *Employer Responsibility*

6.1.4 *Safeguarding the Point of Operation*

6.1.4.2 *Point-of-Operation Devices*.

"**6.1.4.2.6** *Hostage Operator Controls*. It shall be the responsibility of the employer to determine when hostage operator control stations are required and when one or more of the following types shall be allowed for use on a special-purpose power press brake.

(1) *Two-Hand Maintained Controls (Full or Partial Cycle)*. A two-hand maintained power press brake operator control station shall be

installed to protect the operator during a full or partial cycle of the press brake ram by requiring application of both of the operator's hands to the operating control. Each hand control shall be protected against unintended actuation and arranged by separation so that the concurrent use of both hands is required to initiate the power press brake ram motion.

(2) *Single Maintained Controls*. A single maintained power press brake operator control station shall protect the operator by locating the single-cycle operating control station remotely away from the point of operation. The actuation of the operator's control will allow the power press brake ram to complete the closing portion of the cycle before the operator can inadvertently place any part of his body into the point of operation. All single maintained operator control stations shall be protected against unintended actuation."

19. "Shears - Safety Requirements for the Construction, Care, and Use," *ANSI B11.4 1973*. New York: American National Standards Institute, approved August 16, 1973, pp. 26-32.

4. *Construction, Reconstruction, and Modification*

4.3. *Mechanical Power Shears*

"**4.3.1.1** *Foot Control*. Foot-operated tripping controls shall be protected so as to prevent accidental actuation by falling or moving objects, or by someone accidentally stepping on them. They shall be capable of being made inoperative."

"**4.3.1.2** *Hand Control*. A hand control shall be protected against unintended operation."

"**4.3.1.3** *Unintended Operation*. The shear shall be protected to prevent unintended operation by preventing clutch engagement."

"**E4.3.1.3** *Unintended Operation. Some suggested methods for protection against unintended operation are the following:*

(1) Locking pin for the foot treadle, foot pedal, or foot switch
(2) On/Off switch for the foot switch
(3) Removal of the foot pedal
(4) Clutch lock"

4.3.2 *Stroking Control Mechanism - Shears with Part-Revolution Clutches*

"**4.3.2.4** *Foot Control*. Foot-operated tripping controls shall be protected by a guard so as to prevent accidental actuation by falling or moving objects, or by someone accidentally stepping on them. They shall be capable of being made inoperative."

"**4.3.2.5** *Hand Control*. A hand control shall be protected against unintended operation."

"**4.3.2.6** *Unintended Operation*. The shear shall be protected to prevent unintended operation by preventing clutch engagement."

"**E4.3.2.6** *Unintended Operation*. Some suggested methods for protection against unintended operation are the following:

(1) Locking pin for the foot treadle, foot pedal, or foot switch
(2) On/Off switch for the foot switch
(3) Removal of the foot pedal
(4) Clutch lock"

4.4 *Hydraulic or Pneumatic Power Shears*

"**4.4.1.2** *Foot Control*. Foot-operated tripping controls shall be protected so as to prevent accidental actuation by falling or moving objects, or by someone accidentally stepping on them."

"**4.4.1.3** *Hand Control*. A hand control shall be protected against unintended operation.

"**4.4.1.4** *Unintended Operation*. The shear shall be protected to prevent unintended operation."

"**E4.4.1.4** *Unintended Operation*. Some suggested methods for protection against unintended operation are the following:

(1) Locking pin for the foot treadle, foot pedal, or foot switch
(2) On/Off switch for the foot switch
(3) Removal of the foot pedal"

4.7 *Manually Powered Shears*

4.7.1 *Stroking Control Mechanism*

"**4.7.1.3** *Prevention of Unintended Operation*. Manually operated shears shall be provided with a means of locking the hand or foot lever to prevent unintended actuation of the shear."

"**E4.7.1.3** *Prevention of Unintended Operation*. Some suggested devices for prevention of unintended operation are the following:

(1) A locking pin
(2) A latch"

20. "Shears - Safety Requirements for Construction, Care, and Use," ***ANSI B11.4 1993.*** New York: American National Standards Institute, approved January 22, 1993, pp. 12, 17-19, 22, 24-29.

5. *Construction, reconstruction, and modification*

5.1 *General requirements - all shears*.

5.1.5 *Electrical requirements*

"**5.1.5.2** *Motor-start button*. The motor start button shall be protected against accidental actuation."

"**E5.1.5.2** *Motor-start button*. Examples of protection against accidental actuation may include, but are not limited to, recessed buttons, flush buttons, pull on-push off, ring guards, and fabricated shields."

5.2 *Mechanical power shears*

"**5.2.1.3.2** *Hand-operated levers*

The following requirement for hand-operated levers shall apply:

(1) Latch Hand-lever-actuated shears shall be equipped with a spring latch on the operating lever to prevent premature or accidental tripping."

"**5.2.1.3.3** *Unintended actuation*

The trip control mechanism shall be protected to prevent unintended actuation from falling or moving objects, or by accidental stepping onto the mechanism."

"**5.2.1.4.2** *Operating modes...*

(2) Jog. the JOG mode, if provided, shall be designed to prevent exposure of the individual to the point of operation."

"**E5.2.1.4.2** *Operating modes*

(2) Jog. Methods of meeting this requirement include:

- Requiring the concurrent use of both hands to JOG; or,
- Having a single control protected against accidental actuation and so located that the worker cannot reach into the point of operation while operating the single control."

"**5.2.1.4.4** *Actuating means.*

(1) Two-hand trip control. Each hand control shall be protected against unintended actuation and shall be arranged by design, construction or separation so that the concurrent use of both hands is required to trip the shear. (See also 6.3.2).

(2) Foot Control. Foot-operated controls, if provided, shall be protected to prevent actuation from falling or moving objects, or from unintended actuation by accidental stepping onto the foot control."

"**E5.2.1.4.4** *Actuating Means*

(1) Two-hand trip control. This is a construction requirement applying only if the shear is equipped with a two-hand trip control. Two-hand trip control typically is accomplished by:...

(d) Rings or shrouds are commonly used to protect palm-actuated buttons from unintentional actuation. Precaution in design or installation are needed to prevent actuation of two buttons by the use of one hand and the elbow of the same arm and to inhibit other circumvention of the two-hand equipment."

5.2.2.4 *Mechanical actuation of part-revolution clutches*

"**5.2.2.4.2** *Hand-operated levers*

The following requirements for hand-operated levers shall apply:

(1) Latch. Hand-lever-actuated shears shall be equipped with a spring latch on the operating lever to prevent premature or accidental actuation."

"**5.2.2.4.3** *Unintended actuation*

The mechanism shall be protected to prevent unintended actuation from falling or moving objects, or by accidental stepping onto the mechanism."

5.2.2.5 *Electrical/pneumatic actuation system*

"**5.2.2.5.5** *Actuating means*

(1) Two-hand control

Each hand control shall be protected against unintended actuation and shall be arranged by design, construction, or separation so that the concurrent use of both hands is required to initiate the shear.

(2) Foot switch

Foot-operated controls, if provided, shall be protected to prevent actuation from falling or moving objects, or from unintended actuation by accidental stepping onto the foot control."

"**E5.2.2.5.5** *Actuating means*

(1) Two-hand control

Rings or shrouds may satisfy the requirement to protect palm-operated buttons from unintentional actuation. Precautions in design or installation are needed to prevent actuation of two buttons by the use of one hand and the elbow of the same arm, and to inhibit other circumvention of the two-hand requirement."

"**5.2.2.6** *Unintended actuation*

The shear shall be protected against unintended actuation by preventing clutch engagement."

"**E5.2.2.6** *Unintended actuation*

Some suggested methods for protection against unintended actuation are the following:

- locking pin for the foot treadle, foot pedal, or foot switch;
- On/Off switch for the foot switch;
- removable foot pedal;
- clutch lock;
- On/Off switch for control system."

5.3 *Hydraulic or pneumatic power shears*

5.3.3 *Mechanical actuation mechanism*

The following requirements for mechanical actuation mechanisms shall apply:

"**5.3.3.2** *Hand-operated levers*

The following requirements for hand-operated levers shall apply:

(1) Latch. Hand-lever-actuated shears shall be equipped with a spring latch on the operating lever to prevent premature or accidental actuation."

"**5.3.3.3** *Unintended actuation*

The mechanism shall be protected to prevent unintended actuation from falling or moving objects, or by accidental stepping onto the mechanism."

"**5.3.4** *Electrical/hydraulic/pneumatic actuating system*

The requirements in this section shall apply to electrical, pneumatic, or hydraulic controls used to actuate hydraulic shears."

"**5.3.4.5** *Actuating means*

(1) Two-Hand Control. Each hand control shall be protected against unintended actuation and shall be arranged by design, construction, or separation so that the concurrent use of both hands is required to initiate the shear.

(2) Foot Control. Foot-operated controls, if provided, shall be protected to prevent actuation from falling or moving objects, or from unintended actuation by accidental stepping onto the foot control."

"**E5.3.4.5** *Actuating means*

(1) Two Hand Control. Rings or shrouds may satisfy the requirement to protect palm-operated buttons from unintentional actuation. Precautions in design or installation are needed to prevent actuation of two buttons by the use of one hand and the elbow of the same arm, and to inhibit other circumvention of the two-hand requirement."

"**5.3.5** *Unintended operation*

The shear shall be protect against unintended operation by preventing activation of control system."

"**E5.3.5** *Unintended operation*

Some suggested methods for protection against unintended operation are the following:

- locking pin for the foot treadle, foot pedal, or foot switch;
- On/Off switch for the foot switch;
- removable foot pedal;
- On/Off switch for control system."

"**5.3.6** *Control of ram for set-up*

A means shall be provided when required, to prevent hazardous motion of the ram during blade changing, setup or adjustment."

"**E5.3.6** *Control of ram for set-up*

Some suggested methods for protection against unintended motion of the ram are:

1) interlocked pins for ram,
2) Ram blocks,
3) Interlock controls."

5.4 *Manually powered shears*

5.4.1 *Stroking-control mechanism*

"**5.4.1.3** *Prevention of unintended operation*

Manually operated shears shall be provided with a means of locking the hand or foot lever to prevent unintended actuation of the shear."

"**E5.4.1.3** *Prevention of unintended operation*

Some suggested devices for prevention of unintended operation are the following:

- A locking pin,
- A latch,
- Removable foot pedal,
- Removable hand lever."

21. "Iron Workers - Safety Requirements for the Construction, Care, and Use of," *ANSI B11.5 1975*. New York: American National Standards Institute, approved September 18, 1975, pp. 17, 19.

4. *Construction, Reconstruction, and Modification*

4.3 *Machine Stroke Control*

4.3.1 *Stroke Prevention*

"**4.3.1.1** It shall be the responsibility of the manufacturer to provide each new Iron Worker with a means to prevent unintended activation of the ram for the purpose of making the point of operation inoperative."

"**4.3.5** *Foot Control*. A foot control shall have a pad of sufficient dimension to allow an even distribution of the actuating pressure as applied by the operator's foot. The pad shall have a nonslip contact area and shall be firmly attached to the control. The foot control shall be protected so as to inhibit operation from falling or moving objects, or unintended operation by someone accidentally stepping on it. The foot control shall be readily identifiable as to the machine station that it is to operate."

"**E4.3.5** *Foot Control* Some suggested ways to inhibit unintended operation are the following:

(1) Locking pins or latches
(2) On-Off switch
(3) Removal of foot control
(4) Clutch lock

Some suggested ways to identify the foot control as to the machine station that it is to operate are by color coding, labeling, embossing, stencil identification, and variation in guard design."

"**4.3.6** *Hand Lever Controls*. Hand lever controls shall be designed to prevent unintended machine operation."

"**E4.3.6** *Hand Lever Controls*. See E4.3.5."

4.4 *Electrical*

"**4.4.2** *Motor Start Button*. The motor start button shall be protected against accidental operation."

"**E4.4.2** *Motor Start Button*. Some suggested methods of protecting the motor start button are the following:

(1) Recessed or flush buttons
(2) Ring around the start button"

22. "Ironworkers - Safety Requirements for Construction, Care, and Use," ***ANSI B11.5 1988 (reaffirmed 1994)***. New York: American National Standards Institute, approved August 23, 1988, pp. 14, 16.

4. *Construction, Reconstruction, and Modification*

4.3 *Machine Stroke Control*

"**4.3.1** *Stroke Prevention*. (1) The manufacturer shall have the responsibility to provide each new ironworker with a means to prevent unintended activation of the ram for the purpose of making the point of operation inoperative."

"**4.3.5** *Foot Control*. A foot control shall have a pad to allow an even distribution of the actuating pressure as applied by the operator's foot. The pad shall have a nonslip contact area and shall be attached to the control. The foot control shall be protected so as to inhibit operation from falling or moving objects, or unintended operation by someone accidentally stepping on it. The foot control shall be identifiable as to the machine station that it is to operate."

"**E4.3.5** *Foot Control*. Some suggested ways to inhibit unintended operation are the following:

(1) Locking pins or latches
(2) On/Off switch
(3) Removal of foot control
(4)Clutch lock

Some suggested ways to identify the foot control as to the machine station that it is to operate are by color coding, labeling, embossing, stencil identification, and variation in guard design. See E5.1.2."

(**E5.1.2** *Employer*. Recommendations for warning signs and color coding may be found in ANSI Z35.1-1972 and ANSI Z53.1-1979, respectively.)

"**4.3.6** *Hand Lever Controls*. Hand lever controls shall be designed to prevent unintended machine operation."

4.4 *Electrical Requirements*.

"**4.4.2** *Motor Start Button*. The motor start button shall be protected against accidental operation."

"**E4.4.2** *Motor Start Button*. Some suggested methods of protecting the motor start button are the following:

(1) Recessed or flush buttons
(2) Ring around the start button"

23. "Lathes - Safety Requirements for the Construction, Care, and Use of," ***ANSI B11.6 1975***. New York: American National Standards Institute, approved July 17, 1975, pp. 24-25, 29-30.

4. *Construction, Reconstruction, and Modification*

4.3 *Power Clamping Work-Holding Devices*

"**4.3.3.1** *Unclamp Control.* The unclamp control shall be protected from unintentional operation."

"**E4.3.3** *Unclamping Control.* A shrouded push button, cover, or barrier over a manual valve handle are acceptable ways to meet this requirement."

"**4.9** *Vertical-Lathe Table Safety Device.* A method shall be provided that allows the operator to make the table inoperative, thus preventing accidental table rotation."

"**E4.9** *Vertical-Lathe Table Safety Device.* This device is required because it is frequently necessary for the operator on some lathes to get up onto, or lean a portion of his body over, the table in order to make adjustments, measurements, etc. The device could be a selector switch in series with the table start control. Another acceptable method would be to use a mechanical latch or lock-on table start control that requires a definite decision by the operator before the table can be operated."

5. *Safeguarding*

5.9 *Fixed Guards, Moveable Guards, Devices, Awareness Barriers, Awareness Devices, and Shields*

"**5.9.2** *Moveable (Interlocked Guards.* Moveable guards used to satisfy the requirements of this standard shall do the following:...

(4) Contain an interlock so arranged that it cannot be accidentally actuated."

5.9.3 *Devices*

"**5.9.3.3** *Two-Hand Control Used as a Device (See 5.9.3(1)).* A two-hand control shall meet the following requirements:

(1) It shall have the individual operator's hand controls protected against unintentional operation"

24. "Lathes - Safety Requirements for Construction, Care, and Use," ***ANSI B11.6 1984 (reaffirmed 1994)***. New York: American National Standards Institute, approved October 6, 1983, pp. 24-25, pp. 24-25, 28-29.

4. *Construction, Reconstruction, and Modification*

4.3 *Power-Clamping Work-Holding Devices*

"**4.3.3.1** *Unclamp Control.* The unclamp control shall be protected from unintentional operation."

"**E4.3.3.1** *Unclamp Control.* A shrouded push button, cover, or barrier over a manual valve handle are acceptable ways to meet this requirement."

"**4.4** *Foot Controls.* Foot-operated controls, if used, shall be protected to prevent accidental operation from falling or moving objects or from someone accidentally stepping on them."

"**4.9** *Vertical-Lathe Table Safety Device*. A method shall be provided that allow the operator to make the table inoperative, thus preventing accidental table rotation."

"**E4.9** *Vertical-Lathe Table Safety Device*. This device is required because it is frequently necessary for the operator on some lathes to get up onto or lean a portion of his body over, the table in order to make adjustments, measurements, etc. The device could be a selector switch in series with the table start control. Another acceptable method would be to use a mechanical latch or lock-on table start control. that requires a definite decision by the operator before the table can be operated."

5.9 *Fixed Guards, Movable Guards, Devices, Awareness Barriers, Awareness Devices, and Shields*

"**5.9.2** *Movable (Interlocked) Guards*. Movable guards used to satisfy the requirements of this standard shall do the following:...

(4) Contain an interlock so arranged that it cannot be accidentally actuated."

5.9.3 *Devices*

"**5.9.3.3** *Two-Hand Control Used as a Device*. See 5.9.3(1). A two-hand control shall meet the following requirements:

(1) It shall have the individual operator's hand controls protected against unintentional operation."

25. "Cold Headers and Cold Formers - Safety Requirements for the Construction, Care, and Use," *ANSI B11.7 1974*. New York: American National Standards Institute, approved February 25, 1974, pp. 19-21.

3. *Construction, Reconstruction, and Modification*

3.3 *Controls*

"**3.3.2.1** *Run Operating Mode*. The initiation of continuous run shall require the operator to: (1) select Run on the operating-mode selector, (2) position all interlocked guards or shields designed to prevent exposure of any part of the employee's body within the point of operation, and (3) actuate the Run Control. The Run control button shall be protected against accidental actuation by a cover or other protection such as a recessed button. See 5.2."

"**3.3.3** *Foot Controls*. Foot-operated tripping controls, if used, shall be protected to prevent operation from falling or moving objects, or from unintended operation by someone accidentally stepping on them. A non-slip contact surface shall be a part of the pedal. The pedal return spring(s) shall be of the compression type, operating on a rod or guided within a hole or tube, and designed to prevent interleaving of spring coils in the event of breakage."

"**E3.3.3** *Foot Controls*. Foot Controls are normally used with hand feed operations and should provide no less protection than hand controls."

"**3.3.4** *Two-Hand Controls*. Two-hand controls, if furnished, shall be protected against unintended operation and arranged by design and construction, or separation, so that concurrent use of both hand is required for operation."

"**E3.3.4** *Two-Hand Controls*. The use of rings around the palm-operated buttons protects them from unintentional operation. Precautions in design or installation are needed to prevent operation of two buttons by the use of one hand and the elbow of the same arm, or other such attempts to circumvent the two-hand requirement."

"**3.5** *Electrical*. Electrical controls on headers shall be in accordance with American National Standard for Metalworking Machine Tools, 113.1-1973 (NFPA No. 79-1973)."

"**3.5.2** *Motor Start Button*. The motor start button shall be protected against accidental operation."

"**E3.5.2** *Motor Start Button*. The motor start button may be protected against accidental actuation by a cover or other protection such as a recessed button."

26. "Cold Headers and Cold Formers - Safety Requirements for Construction, Care, and Use," ***ANSI B11.7 1985***. New York: American National Standards Institute, approved March 15, 1985, pp. 13-15.

4. *Construction, Reconstruction, or Modification*

4.3 *Controls*

"**4.3.3.1** *Run Operating Mode*. the initiation of continuous run shall require the operator to: (1) select Run on the operating-mode selector, (2) position all interlocked guards or shields designed to prevent exposure of any part of the employee's body within the point of operation, and (3) actuate the Run control. The Run control button shall be protected against accidental actuation by a cover or other protection such as a recessed button. See 6.2."

"**4.3.4** *Foot Controls*. Foot-operated tripping controls, if used, shall be protected to prevent operation from falling or moving objects, or from unintended operation by someone accidentally stepping on them. A nonslip contact surface shall be a part of the pedal. The pedal return spring(s) shall be of the compression type, operating on a rod or guided within a hole or tube, and designed to prevent interleaving of spring coils in the event of breakage."

"**E4.3.4** *Foot Controls*. Foot controls are normally used with hand-feed operations and should provide no less protection than hand controls. Point-of-operation guards or devices should be used when a foot switch is used to initiate operation."

"**4.3.5** *Two-Hand Controls*. Two-hand controls, if furnished, shall be protected against unintended operation and arranged by design and construction, or separation, so that concurrent use of both hands is required for operation."

"**E4.3.5** *Two-Hand Controls*. The use of rings around the palm-operated buttons protects them from unintentional operation. Precautions in design or installation are needed to prevent operation of two buttons by the use of one hand and the elbow of the same arm or by other such attempts to circumvent the two-hand requirement."

"**4.5** *Electrical Requirements*. Electrical controls on new cold formers and new cold headers shall be in accordance with ANSI/NFPA 79-1980."

"**4.5.2** *Motor Start Button*. The motor start button shall be protected against accidental operation by such means as a reset button or other protective device."

27. "Drilling, Milling, and Boring Machines - Safety Requirements for the Construction, Care, and Use of," *ANSI B11.8 1974*. New York: American National Standards Institute, approved May 14, 1974, pp. 15, 24.

3. *Construction, Reconstruction, and Modification*

3.4 *Controls*

3.4.1 *Operator Controls*

"**3.4.1.2** *Accidental Operation*. Controls shall be free from the possibility of accidental operation by normal movement of the machine operator or work."

"**E3.4.1.2** *Accidental Operation*. The requirement does not apply to controls such as"emergency stop" where ease of access is of primary importance."

5. *Safeguarding*

5.6 *Guards. Guarding Devices, Shields, Awareness Barriers, and Awareness Devices*

5.6.3 *Guarding Devices*

"**5.6.3.5** *Two-Hand Control Used as a Device*. A two-hand control shall meet the following construction requirements:

(1) It shall have he individual operator's hand controls protected against unintentional operation."

28. "Drilling, Milling, and Boring Machines - Safety Requirements for Construction, Care, and Use," *ANSI B11.8 1983 (reaffirmed 1994)*. New York: American National Standards Institute, approved March 7, 1983, pp. 15, 23.

3. *Construction, Reconstruction, and Modification*

3.4 *Controls*

"**3.4.1.2** *Accidental Operation*. Controls shall be free from the possibility of accidental operation by normal movement of the machine operator at work.

Exception: This requirement does not apply to controls such as 'emergency stop,' where ease of access is of primary importance."

5. *Safeguarding*

5.6 *Guards, Guarding Devices, Shields, Awareness Barriers, and Awareness Devices*

5.6.3 *Guarding Devices*

"**5.6.3.5** *Two-Hand Control Used as a Device*. A two-hand control shall meet the following construction requirements:

(1) It shall have the individual operator's hand controls protected against unintentional operation."

29. "Grinding Machines - Safety Requirements for the Construction, Care, and Use of," *ANSI B11.9 1975*. New York, American National Standards Institute, approved March 25, 1975, pp. 56-57.

3. *Construction, Reconstruction and Modification*

3.7 *Machine Operation*

3.7.6 *Hazards to Personnel Associated with Unintended Operation of Grinding Machines*

"**3.7.6.1** Machine controls shall be so located, designed, interlocked, or guarded as to inhibit unintended operation that would create a hazard."

"**E3.7.6.1** Such unintended operation my be caused by bumping of the control by the operator or other personnel, or by unclear or ambiguous labeling of control devices."

"**3.7.6.2** Foot-operated tripping controls, if used, shall be protected so as to present accidental actuation by falling or moving objects, or by someone stepping on them."

"**3.7.6.5** Auxiliary equipment of any type operated in conjunction with the grinder shall conform to the requirements of 3.7.6 if unintended operation would create a hazard."

"**E3.7.6.5** Examples of such equipment are piece-part loaders and unloaders, gaging equipment, coolant supply and discharge systems, and filtering or disposal systems for dust, mist, or smoke."

3.7.8 *Control and Power*

3.7.8.2 *Electrical*

"**3.7.8.2.3** *Operating Control*. Any operating control (button or lever) that could initiate a hazardous motion shall be protected against unintended operation."

"**E3.7.8.2.3** *Operating Control*. Operating controls that start spindle rotation, table or head motion, or any other motion that could create a

hazard should be guarded or located where they are not subject to unintended operation."

30. "Metal Sawing Machines - Safety Requirements for the Construction, Care, and Use," *ANSI B11.10 1974*. New York: American National Standards Institute, approved October 29, 1974, p. 28.
4. *Construction, Reconstruction, and Modification*
4.2 *Inherent Hazards (Other than Point-of Operation Hazards)*
4.2.3 *Hazards to Personnel Associated with Unintended Operation of Machine Controls*
"**4.2.3.1** Machine controls shall be so located, designed, constructed, interlocked, or guarded to protect against unintended operation."
"**E4.2.3.1** Such unintended operation may be caused by bumping of the control by the operator or other personnel, or by unclear or ambiguous labeling of control devices."
"**4.2.3.2** When a foot pedal is provided for the purpose of controlling a machine covered in this standard, a means shall be provided to protect against unintended operation."

31. "Metal Sawing Machines - Safety Requirements for Construction, Care, and Use," *ANSI B11.10 1990*. New York: American National Standards Institute, approved September 28, 1990, p. 23.
5. *Construction, Reconstruction, and Modification*
5.2 *Inherent Hazards (Other than Point-of-Operation Hazards)*
5.2.3 *Hazards to personnel associated with unintended operation of machine controls*
"**5.2.3.1** Machine controls shall be so located, designed, constructed, interlocked, or guarded to protect against unintended operation."
"**E5.2.3.1** Such unintended operation may be caused by bumping of the controls by the operator or other personnel, or by unclear or ambiguous labeling of control devices."
"**5.2.3.2** When a foot pedal is provided for the purpose of controlling a machine covered in this standard, a means shall be provided to protect against unintended operation."

32. "Gear-Cutting Machines - Safety Requirements for Construction, Care, and Use," *ANSI B11.11 1985 (reaffirmed 1994)*. New York: American National Standards Institute, approved September 20, 1984, pp. 13, 15.
4. *Construction, Reconstruction, and Modification*
4.2 *Inherent Hazards*

"**4.2.6** *Hazards to Personnel Associated with Unintended Operation of Machine Controls*. Machine controls shall be protected from unintended operation by design or by some appropriate safeguarding means."

5. *Safeguarding at the Point of Operation*

5.3 *Types of Safeguards*

5.3.2 *Protective Devices*

"**5.3.2.2** *Two-Hand Control Device*. A two-hand control device, when used, shall:

(1) Be protected against unintentional Operation."

"**E5.3.2** *Protective Devices*

(1) The use of rings or other similar enclosures around the palm-operated buttons protects them from unintentional operation."

33. "Roll-Forming and Roll-Bending machines - Safety Requirements for Construction, Care, and Use," ***ANSI B11.12 1983***. New York: American National Standards Institute, approved August 15, 1983, pp. 15, 19.

4. *Construction, Reconstruction, and Modification*.

4.3 *Controls*

"**4.3.2** *Jog Controls*. Jog controls, when provided, shall be designed to prevent actuation to deactivate the source of power. The stop control shall override any other control."

"**E4.3.2** *Jog Controls*. The use of jog bars is not recommended."

"**4.3.3** *Run Controls*. Run controls shall be used to start continuous machine operations and shall be guarded to prevent accidental starting of the machine."

"**E4.3.3** *Run Controls*. Examples of meeting this requirement are the use of shielded or recessed run buttons. See Illustration 5."

"**4.3.4** *Foot Controls*. Foot controls, when used, shall be protected to prevent any unintended operation by falling objects or accidental stepping onto the pedal."

"**E4.3.2** *Foot Controls*. See Illustration 6."

4.4 *Electrical Requirements*.

"**4.4.2** *Motor-Start Button*. The motor-start button shall be protected against accidental operation."

6 *Point-of-Operation Safeguarding*

6.3 *Point-of-Operation Devices*

"**6.3.2** *Two-Hand Control Used As a Device*. A two-hand control device, when used, shall meet the following construction requirements:

(1) It shall have the hand control protected against unintentional operation."

34. "Single- and Multiple-Spindle Automatic Screw/Bar and Chucking Machines. Safety Requirements for the Construction, Care, and Use of," ***ANSI B11.13 1975***. New York: American National Standards Institute, approved August 6, 1975, p. 21.

4. *Construction, Reconstruction, and Modification*

"**4.5** *Foot Controls*. Foot-operated controls, if used, shall be protected to prevent accidental operation from falling or moving objects or unintended operation form someone accidentally stepping on them."

35. "Single- and Multiple-Spindle Automatic Bar and Chucking Machines - Safety Requirements for Construction, Care, and Use," ***ANSI B11.13 1992***. New York: American National Standards Institute, approved June 2, 1992, p. 10, 15.

5 *Construction, rebuilding, and modification*

5.3 *Controls*

5.3.1 *Operator controls*

"**5.3.1.2** *Unintentional Operation*. Controls shall be protected to prevent unintentional operation if their actuation creates a hazard."

"**E5.3.1.2** *Unintentional operation*. Examples of protection may include, but not be limited to:

- control location
- control design
- control key lock, switch
- control recess
- control switch guarding"

6 *Safeguarding*

6.2 *Methods of safeguarding*

6.2.3 *Guarding Devices*

"**6.2.3.3** *Two-hand control device*. A two-hand control used to satisfy the requirements of this standard shall meet the following requirements:

(a) It shall have the individual controls protected from unintentional activation."

36. "Machine Tools - Metal Powder Compacting Presses - Safety Requirements for Construction, Care, and Use," ***ANSI B11.16 1988***. New York: American National Standards Association, approved May 10, 1988, pp. 18-21, 23-24, 26-32.

5. *Construction, Reconstruction, Modification, and Conversion*

5.3 *Mechanical P/M Press*

5.3.1 *Part-Revolution Clutch*

5.3.1.1 *Air, Electric, or Hydraulic Activation*

"**5.3.1.1.4** *Inch*. The INCH operating means shall be designed to prevent exposure of the operator within the point of operation by:...

(2) Being a single control protected against accidental actuation and so located that the operator cannot reach into the point of operation while operating the single control."

"**5.3.1.1,5** *Single Stroke Two-Hand Control*. Two-hand controls for SINGLE STROKE, when provided, shall conform to the following requirements:

(1) Each hand control shall be protected against unintended operation and arranged by design, construction, or separation so that the concurrent use of both hands is required to trip the press."

"**5.3.1.1.8** *Foot Control*. Foot-operated controls, if used, shall be protected against unintended operation."

5.3.1.2 *Manual Activation*

"**5.3.1.2.1** *Foot Pedal or Treadle*...

(3) Unintended Operation. The pedal mechanism shall be protected against unintended activation of the control."

"**E(3)** *Unintended Operation*. Some methods for complying with this section are:

(1) Removable foot pedal

(2) Locking pin in the treadle linkage"

"**5.3.1.2.2** *Hand-operated Levers*. Hand-lever-operated P/M presses shall be protected against premature or accidental tripping."

"**E5.3.1.2.2** *Hand-Operated Levers*. Some methods for complying with this section are:

(1) Spring-loaded hand lever

(2) Latching mechanism in the operating linkage

(3) Locking pin in the operating linkage."

"**5.3.2.2.1** *Cycle Start Control*. The cycle start control shall be protected and guarded against accidental operation."

"**5.3.2.2.9** *Foot Control*. Foot-operated control, if used, shall be protected against unintended operation of the control."

"**E5.3.2.2.9** *Foot Control*. Some methods for complying with this section are:

(1) Cover over the foot control

(2) Removable foot pedal

(3) Locking pin in treadle or linkage

(4) Key-lock selector

(5) Plug-in foot control connection"

5.3.2.3 *Manual Activation*

"**5.3.2.3.2**. Foot Pedal or Treadle...

(3) *Unintended Operation*. The pedal mechanism shall be protected to prevent unintended operation."

"**E(3)** *Unintended Operation*. Some methods for complying with this section are:

(1) Removable foot pedal

(2) Locking pin

(3) Latching mechanism"

"**5.3.2.3.3**. *Hand-Operated Levers*. Hand-lever-operated P/M presses shall be designed to prevent premature or accidental tripping."

"**E5.3.2.3.3** *Hand-Operated Levers*. Some methods for complying with this section are:

(1) Removable hand lever

(2) Latching mechanism in the operating linkage

(3) Locking pin in the operating linkage"

"**5.3.3.2**. *Motor Start Button*. The motor start button shall be protected against accidental operation."

"**5.3.3.5**. *Grounds*. All clutch and brake control electrical circuits shall be protected against the possibility of an accidental ground in the control circuit causing false operation of the press."

5.4. *Hydraulic P/M Press*

"**5.4.1** *Controls*. The press control shall control all movement of the press ram by signaling the hydraulic valving."

"**5.4.1.1**. *Cycle Start Control*. The cycle start control shall be protected and guarded against accidental operation."

"**5.4.1.5**. *Inch*. The INCH operating means shall be designed to prevent exposure of the operator within the point of operation by:...

(2) Being a single control protected against accidental actuation and so located that the operator can not reach into the point of operation while operating the single control."

"**5.4.1.6**. *Single Stroke Two-Hand Control*. Two-hand controls for SINGLE STROKE, when provided, shall conform to the following requirements:

(1) Each hand control shall be protected against unintended operation and arranged by design, construction, or separation so that the concurrent use of both hands is required to trip the press."

"**E5.4.1.6**. *Single Stroke Two-Hand Control*. Precautions in design or installation should be followed to prevent operation of two buttons by the use of one hand, the elbow of the same arm, or other such attempts to circumvent the two-hand requirement.

(1) The use of two rings around the palm-operated buttons protects them from unintentional operation."

"**5.4.1.9**. *Foot Control*. Foot-operated controls, if used, shall be protected against unintended operation."

"**E5.4.1.9** *Foot Control*. Some methods for complying with this section are:

(1) Cover over the foot switch
(2) Removable foot pedal
(3) Locking pin in treadle or linkage
(4) Key-lock selector
(5) Plug-in foot-switch connection"

"**5.4.1.10** *Control Component Failure*. P/M press control circuits shall incorporate features to prevent an unintended motion of the press ram in the event of the failure of a control component to function properly, including relays, limit switches, pressure switches valves, fluid controls, and static output circuits."

"**5.4.3.3** *Motor(s) Start Button*. The motor(s) start button shall be protected against accidental operation."

5.4.4 *Hydraulic Equipment*

5.4.4.2 *Hydraulic Circuits and Application*

"**5.4.4.2.3** *Valving*. Design and circuit application shall prevent unintended ram closing in case of valve failure."

"**5.4.4.2.4** *Piping*. Hydraulic piping, including pipe, tubing, hose, and associated fittings, shall be selected so as to provide adequate service factors, based upon rated operating parameters, to prevent unintended motion in the event of failure."

6. *Safeguarding the Point of Operation*

6.2 *Point-of-Operation Guards*

6.2.2 *Interlocked Press Barrier Guard*

"**6.2.2.1** *General*. An interlocked P/M press barrier guard, when used, shall be attached to the press frame, die table, or die platen and shall be interlocked with the press controls so that the press cannot be actuated unless the guard itself, or the hinged or movable sections of the guard, is in place."

37. "Machine Tools - Horizontal Hydraulic Extrusion Presses - Safety Requirements for Construction, Care, and Use," *ANSI B11.17 1982*. New York: American National Standards Association, approved August 9, 1982, pp. 12-14.

3. *Construction and Modification*

3.2 *Inherent Hazards*

"**E3.2.4** *Shutdown Provisions*. These should include provisions for disconnecting or locking out the electrical systems and releasing or safely containing the stored energy in the hydraulic and pneumatic systems on the press. These provisions are required to prevent inadvertent movement of press components."

3.5 *General Electrical Requirements*

"**3.5.1** *Press Pump Motor(s) Control*. The press control circuit shall incorporate adequate means to safely start the press pump motors under a control condition which will not initiate inadvertent motion of the press components."

38. "Safeguarding When Referenced by the Other B11 Machine Too Safety Standards - Performance Criteria for the Design, Construction, Care, and Operation," *ANSI B11.19 1990*. New York: American National Standards Institute, approved February 28, 1990, p. 25.
4. *Safeguarding: Guards, Devices, Awareness Barriers, Awareness Signals, Shields, and Methods*
4.2 *Devices*
4.2.4 *Two-Hand Operating Lever, Trip and Control Devices*
4.2.4.2 *Design and Construction*
"**4.2.4.2.2** *Two-Hand Trip Devices*. Each two-hand trip shall be designed and constructed to protect each hand trip against accidental or unintentional operation."
"**E4,2,4,2,2** *Two-Hand Trip Devices*. Protecting the two-hand trip against accidental operation is usually accomplished by the use of ring or palm guards or other fabricated shields.
The design or installation of the operator control should be such that the operator cannot operate the two controls by the use of one hand and an elbow of the same arm.
Characteristics of the total system of the two-hand trip and the drive or clutch mechanism may be combined to achieve antirepeat; that is, while the single-cycle limiting requirement may be achieved by the single-cycle mechanism in the clutch, the two-hand trip should have a feature that requires release of all operating mechanisms (buttons, valves, or levers) before another stroke can be initiated.
A key-operated selector switch is sometimes used to supervise the use of each operator control station."
"**4.2.4.2.3** *Two-Hand Control Devices*. The two-hand control shall be designed to protect each hand control against accidental or unintentional operation."
"**E4.2.4.2.3** *Two-Hand Control Devices*. Protecting the hand control against accidental operation is usually accomplished by the use of ring palm guards or other fabricated shields."

39. "Safety Requirements for Forging," *ANSI B24.1*. New York" American National Standards Institute, approved January 5, 1971, reaffirmed 1975, p. 18.
7. *Hammers - General Requirements*
"**7.8** *Foot-Operated Devices*

All foot-operated devices (that is, treadles, pedals, bars, valves, and switches) shall be substantially and effectively protected from unintended operation.

Unintended operation includes actuation from falling or moving objects or accidental foot contact. Protection can be provided to prevent unintended operation by the location, design,, physical covering of the device, or by a feature at the device which can make the device inoperable."

40. "For Rubber Machinery - Hydraulic Molding and Curing Presses - Safety Requirements for Construction, Care, and Use," *ANSI B28.4*. New York: American National Standards Institute, approved April 12, 1982, p. 7.
3. *Construction, Installation, and Modification*
3.3 *Electrical Equipment*
"3.3.2 *Push Buttons*. Push buttons that initiate the closing motion of the press shall be protected against accidental operation."
"E3.3.2 *Push Buttons*. "Start" buttons should either be recessed or guarded by a protective sleeve."

41. "For Rubber Machinery - Roll-Building Machines using Full-Face Pressure Rolls - Safety Requirements for Construction, Care, and Use," *ANSI B28.5-1983*. New York: American National Standards Institute, approved March 7, 1983, p. 6.
4. *Construction, Reconstruction, and Modification*
4.3 *Electrical*
"4.3.2 *Hand-Operated Push Buttons*. Hand-operated push buttons shall be protected against accidental operation, with the exception of "Stop" buttons, either by type of button or by location."
"*Note*: The start button is protected to prevent starting by accidental bumping; the safety button is of the 'mushroom' type for quick stopping."
"4.3.3 *Foot-Operated Controls*. Foot-operated controls shall be protected by means of a guard over the control pedal, against accidental operation from an object or foot coming downward directly onto the pedal."

42. "Safety Standard - Printing Press Systems," *ANSI B65.1 1995*. New York, American National Standards Institute, approved December 7, 1995, p. 8.
7 *Pushbuttons*
7.2 *Mechanical Specification of Pushbuttons*
7.2.10 *Stop/Safe-Ready Pushbutton*
"The latching mechanism shall be of a design that prevents a person from unintentionally releasing the pushbutton to the READY condition."

43. "Safety Standard for Guillotine Paper Cutters," *ANSI B65.3-1991*. New York: American National Standards Institute, approved 1991, p. 3.

5. *Operator Control Systems*

"All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation."

"**5.1** *Two-Hand Controls*

To insure that the hands are not in the cutting zone, a two-hand control shall be required to initiate a cutting cycle or an automatic cut sequence. A two-hand control:

- shall be positioned and protected to prevent inadvertent operation and to discourage deliberate circumvention;
- shall be impossible to span with one hand;..."

44. "for Fasteners - Rivet Setting Equipment - Safety Requirements for Construction, Care, and Use," *ANSI B154.1-1984*. New York: American National Standards Institute, approved October 18, 1983, p. 14-16.

3. *Construction, Reconstruction, and Modification*

3.4 *Machines Using Full-Revolution Clutches and Full-Revolution Clutches with Intermittent Fixed Stop(s)*

3.4.3 *Foot Pedal (Treadle)*

"**3.4.3.3** *Unintended Operation*. The pedal mechanism shall be guarded to prevent unintended operation from falling or moving objects, or from someone accidentally stepping onto the pedal."

"**E3.4.3.3** *Unintended Operation*. A common type guard would be fabricated from sheet-metal stock or 12-gage, 0.105-inch (3mm), minimum thickness and formed over the treadle with an enclosure area sufficient to allow the operator's foot to enter without interference. The enclosure should extend over the entire length of the treadle arm, to prevent objects from striking any part of the treadle arm."

"**3.4.4** *Two-Hand Trip*. A two-hand trip shall:

(1) Have the individual operator's hand controls protected against unintentional operation."

3.5 *Machines Using Part Revolution Clutches*

3.5.2 *Controls*

3.5.2.4 *Single-Cycle Two-Hand Control.*

"**3.5.2.4.1** *Two-Hand Control*. Each hand control shall be protected against unintended operation and arranged by design and construction, or separation, or both, so that the concurrent use of both hands is required to trip the machine (see 2.9.5)."

"**3.5.2.8** *Foot Control*. Foot-operated tripping controls if used, shall be protected so as to prevent unintended operation from falling or moving objects, or from someone accidentally stepping onto the foot control."

3.6 *Electrical*

"**3.6.2** *Motor Start Actuator*. The motor start actuator shall be protected against accidental operation."

45. "For Envelope Manufacturing Machinery - Safety Requirements for the Construction, Care, and Use," ***ANSI B169.1-1990***. New York: American National Standards Institute, approved April 23, 1990, pp. 11-12, 15, 18-19, 21-22, 24-25, 28, 31, 34-35.

5. *Envelope Folding Machines*

5.2 *Electrical Components*

5.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement of machine components or operators."

"**5.2.1.1** *Start Buttons and Switches*

(1) All motor start buttons and switches shall be protected against accidental operation. The start button should be marked with the color green."

"**E5.2.1.1** *Start Buttons and Switches*

(1) Some of the ways start buttons can be protected include flush-mounted buttons and side-guarded toggle switches."

This explanation is repeated in each of the following sections.

"**5.2.2** *Lockout Devices*. Means shall be provided to enable the mechanic to lock the machine in the 'off' condition to prevent accidental operation, which could be hazardous to anyone working on the machine."

"**E5.2.2** *Lockout Devices*. This protection can be provided by a power disconnecting switch to which a padlock may be attached, or by comparable means."

This explanation is repeated in each of the following sections.

6. Paper Die Cutters

6.2 *Electrical Components*

6.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement or machine components or operators."

"**6.2.1.1** *Start Buttons and Switches*

(1) All motor start buttons and switches shall be protected against accidental operation....

(2) Two-hand trip or control switches, when used, shall be designed to prevent accidental activation and shall be located to inhibit any operation other than the intended two-handed activation."

6.2.2 *Lockout Devices*

"(1) Means shall be provided to enable the mechanic to lock the machine in the 'off' condition to prevent accidental operation, which could be hazardous to anyone working on the machine."

7. *Automatic Metal-Clap Machines and String and Button Machines*

7.2 *Electrical Components*

7.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement of machine components or operators."

7.2.1.1 *Start Buttons and Switches*

"(1) All motor start buttons and switches shall be protected against accidental operation....

(2) Two-hand trip or control switches, when used, shall be designed to prevent accidental activation and shall be located to inhibit any operation other than the intended two-handed activation."

"7.2.2 *Lockout Devices*. Means shall be provided to enable the mechanic to lock the machine in the "off" condition to prevent accidental operation, which could be hazardous to anyone working on the machine."

8. *Hand-Reed Metal-Clasp Machines, String and Button Machines, Paper Drills, and Open-Window Die Presses*

8.2 *Electrical Components*

8.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement or machine components or operators."

8.2.1.1 *Start Buttons and Switches*

"(1) All motor start buttons and switches shall be protected against accidental operation....

(2) Two-hand trip or control switches, when used shall be designed to prevent accidental activation and shall be located to inhibit any operation other than the intended two-handed activation."

"8.2.2 *Lockout Device*. Means shall be provided to enable the mechanic to lock the machine in the 'off' condition to prevent accidental operation, which could be hazardous to anyone working on the machine.'

9. *Straight-Knife Cutters*

9.2 *Electrical Components*

9.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement of machine components or operators."

"9.2.1.1 *Start Buttons and Switches*

(1) All motor start buttons and switches shall be protected against accidental operation...

(2) Two-hand trip or control switches, when used, shall be designed to prevent accidental activation and shall be located to inhibit any operation other than the intended two-handed activation."

9.2.2 *Lockout Devices*

"(1) Means shall be provided to enable the mechanic to lock the machine in the 'off' condition to prevent accidental operation, which could be hazardous to anyone working on the machine."

10. *Sheeters*

10.2 *Electrical Components*

10.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement of machine components or operators."

10.2.1.1 *Start Buttons and Switches*

"(1) All motor start buttons and switches shall be protected against accidental operation...."

"**10.2.2** *Lockout Devices*. Means shall be provided to enable the mechanic to lock the machine in the "off" condition to prevent accidental operation, which could be hazardous to anyone working on the machine."

11. *Printing Presses*

11.2 *Electrical Components*

11.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement of machine components or operators."

11.2.1.1 *Start Buttons and Switches*

"(1) All motor start buttons and switches shall be protected against accidental operation....

"(2) Two-hand trip or control switches, when used, shall be of a design to prevent accidental activation and shall be located to inhibit any operation other than the intended two-handed activation."

"**11.2.2** *Lockout Devices*. Means shall be provided to enable the mechanic to lock the machine in the 'off' condition to prevent accidental operation,..."

12. *Balers*

12.2 Electrical Components

12.2.1 *Operator Controls*

"(3) All electrical control switches shall be constructed or installed in a manner that will inhibit accidental operation by normal movement or machine components or operators."

12.2.1.1 *Start Buttons and Switches*

"(1) All motor start buttons and switches shall be protected against accidental operation....

"(2) Two-hand trip or control switches, when used, shall be designed to prevent accidental activation and shall be located to inhibit any operation other than the intended two-handed activation."

"**12.2.2** *Lockout Devices*. Means shall be provided to enable the mechanic to lock the machine in the 'off' condition to prevent accidental operation, which could be hazardous to anyone working on the machine."

46. "Safety and Health Requirements for the Textile Industry," *ANSI L1.1-1981*. New York: American National Standards Institute, approved May 29, 1981, p. 17.

7. *General Engineering Controls*

7.4 *Controls*

"**7.4.1** Whenever accidental activation of a control could cause a danger, the control shall be so designed, positioned, or guarded as to minimize the chance of such an occurrence."

"**E7.4.1** Control guards usually involve covers over foot-operated switches and extended shields around buttons."

47. "For Woodworking Machinery - Safety Requirements," *ANSI O1.1-1992*. New York: American National Standards Institute, approved October 1, 1992, p. 19.

4 *General requirements for construction, reconstruction and modification of a woodworking machine*

4.4 Controls

4.4.1 Operator controls

"**4.4.1.2** Unintended actuation

Controls shall be designed to minimize the possibility of unintended actuation by the normal movement of the machine operator or work.

"EXCEPTION: This requirement does not apply to emergency stop controls."

ASAE STANDARD

48. "Operator Controls on Agricultural Equipment," *ASAE S335.4*. St. Joseph: MI, The Society for Engineering in Agricultural, Food, and Biological Systems, adopted December 1969, last revised March 1980, reconfirmed December 1991.

Section 3 - General

"**3.4** The inclusion of secondary motion requirement shall be considered in the design of all controls to reduce the likelihood of inadvertent actuation from the off or neutral position...."

BRITISH STANDARDS AND EUROPEAN STANDARDS

49. "Power-Driven Derrick Cranes," ***BS 327: 1964***. London: British Standards Institution, 5th revision, April 1964, p. 25.

40. *Control Handles and Levers*

"All control handles and pedals shall be placed in convenient positions to allow the driver ample room for operation and an unrestricted view of the of load.

"The positions of controls shall be such that when the driver is intentionally operating any control handle he cannot readily operate any other control handle inadvertently."

50. "Guarding of Machinery," *British Standard Code of Practice, **CP 3004: 1964***. London: British Standards Institution, p. 21, 26. (This standard was superseded by BS 5304: 1975.)

Section 4. Safety by Design

"**402. Controls**. All controls (especially those for use by operations in the normal working of the machine), including levers, buttons, switches, pedals and handwheels, should be designed and positioned to be easy of access to the operator, clearly identifiable, and the operator normally has them within easy reach without stretching or moving from the usual operating position.

"Where more than one starting control is provided, as in the case of a machine having alternative places for the operators to work, either it should be impossible to start the machine with more than one control, all others being isolated, or the arrangements should be such that all starting controls must be simultaneously operated in order to secure movement. Starting controls should be suitable shrouded to prevent accidental operation."

Section 6. Electrical Considerations

"**603 Operation of controls**. Attention should be given to the position, layout and protection of electrical controls so as to prevent their accidental operation."

51. "Safeguarding of machinery," ***BS 5304: 1975***. London: British Standards Institute, pp. 14-15.

27 *Controls*

27.1 *Position*

"Start controls should be shrouded or otherwise protected to prevent inadvertent operation. Near each start control should be a stop control.

"Handles, handwheels and levers should be so positioned that when the operator is intentionally operating them he cannot inadvertently operate any other control...."

52. "Safety of machinery," *BS 5304: 1988*. London British Standards Institution, pp. 26-27.

Section five. Machinery design

5.3 *Controls*

5.3.1 *Position*

"Start controls should be shrouded, gated or so positioned that they cannot be operated inadvertently."

"Handles, handwheels and levers should be so positioned that when the operator is operating them he cannot inadvertently operated any other control....

"Foot operated controls, other than for emergency stop, should be adequately shrouded or otherwise arranged to prevent, as far as possible, accidental operation from any cause. Pedals should not be of greater width than that required for foot operation. Movable pedals should be shrouded to permit access from one direction only."

5.3.3 *Operation*

"Where practicable, the mode and movement of controls should be so varied as to prevent inadvertent operation of the wrong control."

53. "Safety of machinery - Basic concepts, general principles for design. Part 1. Basic terminology, methodology, ***BS EN 292: Part 1***. Brussels: European Committee for Standardization approved September 20, 1991, p. 5.

3 *Basic concepts*

3.13 *Safety functions*

3.13.1 *Safety critical functions*

"Those functions of a machine, the malfunction of which would immediately increase the risk of injury or damage to health.

There are two categories of safety critical functions:

(a) *Safety-specific functions*, which are safety critical functions specifically intended to achieve safety.

Examples - function preventing unintended/unexpected start-up (interlocking device associated with a guard...),"

54. "Safety of machinery - Basic concepts, general principles for design. Part 2. Technical principles and specifications," ***BS EN 292: Part 2***. Brussels: European Committee for Standardization, approved September 20, 1991, pp. 7, 18.

3 *Risk reduction by design*

3.7 *Applying safety principles when designing control systems*

3.7.8 *Principles relating to manual control*

"f) Controls shall be designed or protected so that their effect, where a risk is involved, cannot occur without intentional operation."

Annex A (informative)

1. *Essential Health and Safety Requirements*
1.2 *Controls*
1.2.2 Control devices
"Control devices must be:...
- designed or protected so that the desired effect, where a risk is involved, cannot occur without an intentional operation."

55. "Earth-Moving Machinery - Safety, Part 1: General requirements," ***EN 474-1***. Brussels, European Committee for Standardization, July 1994, p. 12.
4 *Safety requirements and/or measures*
4.4 *Controls and indicators*
4.4.2 *Controls*
"**4.4.2.3** *Inadvertent activation*
Controls which can cause a hazard due to inadvertent activation shall be so arranged or deactivated or guarded such that they cannot be activated inadvertently and in particular when the operator gets into or out of the operator's station."

56. "Earth-moving machinery - Safety, Part 4. Requirements for backhoe loaders," ***BS EN 474-4***. Brussels: European Committee for Standardization, effective July 16, 1996, p. 6.
4 *Safety requirements*
4.6 *Operator's controls*
4.6.1 *Remote control*
4.6.1.1 *Control box*
Activation of controls shall only be possible from a portable remote control box.
"**4.6.1.1.3 Controls** The control box shall have clearly marked directions of movements for the machine and its attachment and be safeguarded against unintentional actuation e.g. pushbuttons with protective collars. It shall be possible to lock the controls in the deactivated mode against unintentional or unauthorized actuation."

57. "Electrical equipment of industrial machines, Part 1. Specification for general requirements," ***BS 2771: Part 1: 1986 (EN 60 204: Part 1: 1985)***. Brussels: European Committee for Electrotechnical Standardization, ratified May 10, 1984, p. 50.
8 *Control devices*
8.2 *Hand-operated control switches and indicator lights*
8.2.1 *Accessibility of switches*
"The actuators shall be designed and positioned so as to minimize the risk of inadvertent operation."

CSA STANDARDS

58. "Construction and Test of Electrically Equipped Machine Tools," *CSA C22.2 No. 73*. Ottawa, Ontario: Canadian Standards Association, effective February 28, 1953, pp. 12-13.

Specification Details

Construction

"**25**. Push buttons or switches for starting and controlling motors shall be so located or guarded that there will be no liability of a motor being started unintentionally due to accidental operation, and shall be interlocked mechanically or electrically if necessary to prevent hazardous operation of the machine.

"Subject to the above requirements, start buttons may be of the mushroom type."

59. "Safety Code for the Woodworking Industry," *CSA Z114-M*. Rexdale, Ontario, Canada: Canadian Standards Association, published March 1977, pp. 25-26.

3. *Machines and Equipment*

3.2 *Machine Controls*

"**3.2.3** The start control shall be of such design* as to minimize the chance of the control being operated accidentally.

"**Example: Ring guard around the start control button.*"

"**3.2.8** Foot operated controls and levers shall be located or protected so that they cannot be shifted or accidentally tripped. Each operated control shall be covered by an inverted U-shaped metal guard securely fastened and of such a size to prevent an accidental start-up or stoppage of the machine."

60. "Code for the Guarding of Punch Presses at Point of Operation," *CSA Z142*. Rexdale, Ontario, Canada: Canadian Standards Association, published 1976, pp. 9, 13.

3. *General Requirements*

3.2 *Mechanical*

"**3.2.3** With regard to foot pedal and treadle:

(a) The treadle pad and treadle bar shall be protected to prevent unintended actuation by accidentally stepping thereon, or from falling objects;..."

"**3.2.4** Hand-lever operated presses shall be equipped with a spring latch to prevent accidental tripping. Where operated by more than one person, such presses shall be interlocked to require the concurrent use of all levers before tripping can occur."

4. *Safeguarding the Danger Zone*

4.5 *Two-Hand Control Device*

"**4.5.4** The controls shall be located or protected by barriers so that the operator cannot actuate the controls unintentionally or by the use of one hand and some other part of his body."

IEEE

61. "IEEE Standard for Electrical Installations on Packaging Machinery and Associated Equipment," ***IEEE 333*** 1980. New York: Institute of Electrical and Electronics Engineers, Inc., p. 17.
10. *Operator's Control, Stations and Equipment*
10.4 Location of Control Stations
"...Controls shall be free from possibility of accidental operation by normal movement of the machine or operator."

NFPA STANDARDS

62. "Metal Working Machine Tools," *NFPA 79 -1962*. Quincy, MA: National Fire Protection Association, adopted 1962, p. 26.
Chapter 180. *Operator's Control; Stations and Equipment*
180-9. *Location of Control Stations*.
"**(c)** Controls shall be free from possibility of accidental operation by normal movement of the machine, operator or work."

63. "Electrical Standard for Metalworking Machine Tools and Plastics Machinery," *NFPA 79-1980*. Quincy, MA: National Fire Protection Association, the 1977 ed. ANSI adopted July 18, 1977. The 1980 ed. has been submitted for ANSI approval, pp. 31-32, 34.
Chapter 8. *Location and Mounting of Control Equipment*
8.5 *Machine Mounted Control Equipment*
"**(a)** Control equipment such as limit switches, brakes, solenoids, position sensors, etc., shall be mounted rigidly in a reasonably dry and clean location, and shall be free from possibility of accidental operation by normal machine movements or by the operator...."
Chapter 9. *Operator's Control Stations and Equipment*
9-1 *Pushbuttons, Selector Switches, Indicating Lights*.
"(e) Pushbutton operators used to initiate a "start" function or movement of machine elements (slides, spindles, carriers, etc.) shall be constructed or mounted so as to minimize inadvertent operation.
"Exception: Mushroom-type operators shall be permitted to initiate "start" functions when installed in accordance with Section 9-3."
9-3 *Two-Hand Control*. "Two-hand control, where used, shall:
(a) Be protected against unintentional operation."

9-4 *Foot-Operated Switches.*

"**(a)** Foot-operated switches shall be protected so as to prevent accidental actuation by falling or moving objects and from unintended operation by accidental stepping onto the switch."

9-8 *Location of Control Stations.*

"**(c)** Controls shall be located so that unintentional operation by normal movement of the machine, operator, or work will be unlikely."

64. "Electrical Standard for Industrial Machinery," *NFPA 79-1994*. Quincy, MA: National Fire Protection Association, effective August 5, 1994, pp. 24, 26-27.

9 *Control circuits*

9-14 *Two-hand control circuits*

"Where used to initiate potentially hazardous motion, two-hand control devices shall be protected against unintentional operation..."

12 *Location and mounting of control equipment*

12.6 *Machine-mounted control equipment*

"**12.6.1** Control equipment, such as limit switches, brakes, solenoids, position sensors, etc., shall be mounted rigidly in a reasonably dry and clean location, shall be protected from physical damage, and shall be free from the possibility of accidental operation by normal machine movements or by the operator...."

13 *Operator's control stations and equipment*

13.1 *Pushbuttons, selector switches, indicating lights*

"**13.1.5** Pushbutton operators used to initiate a start function or movement of machine elements (slides, spindles, carriers, etc.) shall be constructed or mounted to minimize inadvertent operation."

13.3 *Foot-operated switches*

"**13.3.1** Foot-operated switches shall be protected to prevent accidental actuation by falling or moving objects and from unintended operation by accidental stepping onto the switch."

13.7 *Location of control stations*

"**13.7.3** Controls shall be located so that unintentional operation by normal movement of the machine, operator, or work will be unlikely."

SAE STANDARDS and RECOMMENDED PRACTICES

65. "Personnel Protection for General Purpose Industrial Machines," *SAE J98*. Warrendale, Pa: Society of Automotive Engineers, Inc., approved May 1973, revised November 1992.

9 *Shields or Guards*

"**9.4** Power Drive on Propelling Machines and Equipment -- The acute entry angles of exposed gears, belts, and chain drives and idlers shall be covered

by shield, rods, mesh, or other portions of the machine to minimize the possibility of inadvertent contact."

66. "Operator Controls on Industrial Equipment," *SAE J297*. Warrendale, PA: Society of Automotive Engineers, Inc.,approved May 1973, reaffirmed August 1994.
6 *Ground Speed and Directional Control*
"**6.2** When a hand-operated forward-reverse directional control lever (non-variable speed) is provided, it shall be moved forward for forward machine motion and be moved generally reward for rearward machine motion. If a neutral position is provided, provision shall be made to prevent accidental movement of the control."

67. "Operator Controls for Agricultural Wheeled Tractors," *SAE J841*. Warrendale, PA: Society of Automotive Engineers, Inc., approved June 1963, revised December 1984.
7 *Ground Speed and Direction Control*
"**7.2** When a hand-operated forward-reverse directional control lever (nonvariable speed) is provided, it shall be moved forward for forward vehicle motion, and be moved generally rearward for rearward vehicle motion. If a neutral position is provided, provisions shall be made to prevent accidental movement of the control."

68. "Snowmobile Brake Control System," *SAE J1282*. Warrendale, PA: Society of Automotive Engineers, Inc., approved September 1980, reaffirmed May 1995.
4 *Requirements and Recommendations*
"**4.1.7** The brake control system shall be protected so that with all guards and shrouds in place, it cannot be inadvertently pulled or snagged in a manner that would activate the brake."

69. "Operator Controls - Off-Road Machines," *SAE J1814*. Warrendale, PA: Society of Automotive Engineers, Inc., approved February 1993.
3 *General Criteria*
3.3 *Control Location, Displacement Resistance*
"**3.3.9** Minimum control resistance shall be sufficient to avoid inadvertent actuation by the force of the hand or foot resting on the control during anticipated operating condition...."
3.5 *Control Arrangement*
"**3.5.2** Space between controls shall be sufficient to allow operation without unintentional actuation of adjacent controls. Suggested minimum clearances between controls are as follows:
a. Finger tip operated - 10 mm - if control is 10 N or less

b. Hand operated (palm grasp) -
25 mm - if control resistance is 50 N or less
50 mm - if control resistance is greater than 50 N
c. Foot operated - 50 mm"

UNDERWRITERS LABORATORIES STANDARDS

70. "Portable Electric Tools," *ANSI/UL 45*, 8th ed. Northbrook, IL: Underwriters Laboratories Inc., ANSI approved May 6, 1997, p. 27.
26 *Switches and Controls*
"**26.3** If unintentional operational of a switch, including a reversing switch, can result in risk of injury to persons, the switch shall be so located or guarded that such operation is unlikely."

71. "Motor-Operated Appliances," *ANSI/UL 73*, 8th ed. Northbrook IL: Underwriters Laboratories Inc., ANSI approved April 16, 1993, p. 37.
33 *Switches, Controls, and Interlocks*
"**33.4** If unintentional operation of a switch can result in a risk of injury to persons, the actuator of the switch shall be located or guarded so that such operation is unlikely."
"**33.6** The actuator of an interlock switch shall be located so that unintentional operation is unlikely."

72. "Electric Gardening Appliances," *ANSI/UL 82*, 6th ed. Northbrook, IL: Underwriters Laboratories Inc., ANSI approved June 23, 1994, p. 24.
17 *Switches and Controls*
"**17.2** A switch shall be located or protected so that it is not likely to be operated unintentionally during intended use of the appliance."

73. "Electric Snow Movers," *UL 1090*, 3rd ed. Northbrook, IL: Underwriters Laboratories Inc., December 2, 1986, p. 19.
24. *Switches and Controls*
"**24.2** If unintentional operation of a switch can result in a risk of injury to persons, the switch shall be located or protected so that such unintentional operation is unlikely."

74. "Electric Lawn Mowers," *UL 1447*, 3rd ed. Northbrook, IL: Underwriters Laboratories Inc., June 20, 1994, p. 28.
16 *Switches and Controls*
"**16.7** A switch shall be located or protected so that it is unlikely to be subject to unintentional operation during intended use."

75. "Electric Hedge Trimmers," *UL 1448*, 2nd ed. Northbrook, IL: Underwriters Laboratories Inc., March 31, 1980, p. 19.

21. *Electrical Control*

"**21.6** Operation of a switch and its lock-on, if provided, shall be located so that it will not be subject to inadvertent operation in use with either hand."

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